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New records of *Aspicilia* species from China

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Abstract — As a result from our studies on the lichenized ascomycete genus *Aspicilia*, the species *A. persica*, *A. verrucigera,* and *A. subdepressa* are reported for the first time from China.

Key words — lichen, taxonomy

Introduction

Aspicilia A. Massal. (*Megasporaceae, Pertusariales, Ascomycota*), a lichen genus with worldwide distribution, includes over 200 species (Kirk et al. 2008). Forty-one species have previously been reported from China (Wei 1991, Abbas & Wu 1998, Sohrabi et al. 2010a). Our recent studies on *Aspicilia* establish that three additional species occur in China: *A. persica*, *A. verrucigera,* and *A. subdepressa*.

Materials & methods

The specimens studied are preserved in SDNU (Lichen Section of the Botanical Herbarium, Shandong Normal University). Specimen morphology and anatomy were examined using a dissecting microscope (Olympus SZ51) and a compact light microscope (Olympus CX41). The lichen substances were detected by standardized thin layer chromatography techniques (TLC) with solvent C (Orange et al. 2010). Photos of the morphology were taken with an Olympus SZX16 stereomicroscope and of the anatomy with an Olympus BX61 compound microscope with DP72.

New records

Aspicilia persica (Müll. Arg.) Sohrabi, Sauteria 15: 467. 2008. Fig. 1

Thallus crustose, rimose to areolate, ± orbicular, subradiate, 2–5.5(–7) cm in diam., ± 0.5 mm thick; areoles angular to irregular, 0.7–1.2(–1.5) mm in diam., convex, continuous, fissured, cracks lighter towards the thallus edge;

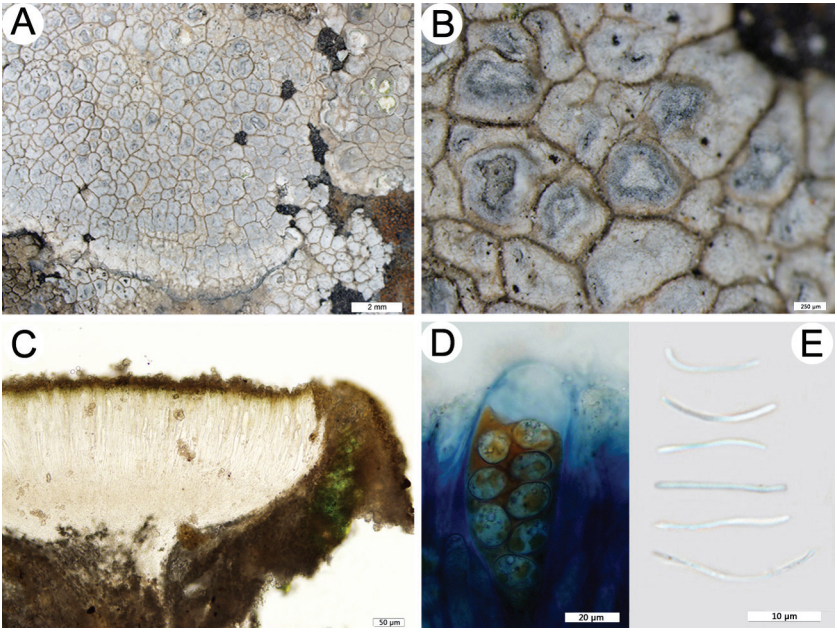

Figure 1. *Aspicilia persica* (Z.L. Huang 20106405). A. Habitus; B. Apothecia; C. Apothecial anatomy; D. Ascus and ascospores after I treatment; E. Conidia. Scale bars: A = 2 mm; B = 250 µm; C = 50 µm; D = 20 µm; E = 10 µm.

prothallus sometimes present, black. Upper surface white-gray to white, matt, densely pruinose. Apothecia prominent, aspicilioid, usually solitary in the areoles, 0.3–0.9 mm in diam.; thalline margin prominent, usually forming a black rim, or sometimes somewhat paler due to the dense pruina; disc black, with dense white pruina; epithecium olive-green to olive-brown, K+ brown, N+ green; hymenium hyaline, I+ blue, 125–167.5 µm high; paraphyses separating in KOH, moniliform; subhymenium and hypothecium colorless, I+ blue, together 62.5–87.5 µm thick, without algae below the hypothecium; asci clavate, *Aspicilia*-type, 8-spored; ascospores hyaline, simple, ellipsoid, 17.5–22.5×13–15 µm; conidia filiform, 15–25× 0.8–1 µm.

Spot tests — Medulla K+ yellow, C–, I–, P+ orange.

Secondary metabolites — Stictic acid (major), norstictic acid (minor).

Specimens examined — **China. Xinjiang.** Urumqi city, Mt. Tianshan, Glacier No.1, alt. 3800 m, on siliceous rock, 27 Aug. 2011, Z.L. Huang 20106405 (SDNU); L. Li 20125895 (SDNU).

Comments — *Aspicilia persica* is characterized by convex areoles, medium-sized ascospores, prominent thalline margins, and black disks covered by dense white pruina. *Aspicilia boykinii* Owe-Larss. & A. Nordin, which also has a white

or gray-white thallus and prominent thalline margins, looks like *A. persica* but differs in its smaller spores, thin thalline margin, flat or (sometimes) convex areoles, and white or gray apothecial rims. *Aspicilia candida* (Anzi) Hue, another species with white upper surface, differs from *A. persica* by having a rather low (75–85 µm) hymenium and submoniliform paraphyses. *Circinaria calcarea*, a subradiate and calciferous species with white thalli, also resembles *A. persica* but has 4-spored asci, shorter conidia, and a K– thallus.

Aspicilia persica is a saxicolous species, known previously only from Iran (Szatala 1957, Seaward et al. 2004, Sohrabi et al. 2010b).

Aspicilia verrucigera Hue, Nouv. Arch. Mus. Hist. Nat., 5 Sér., 2: 48. 1912. Fig. 2

Thallus crustose, distinctly verrucose-areolate in the center, sometimes rimose at the edge, 2–5 cm in diam., ± 0.5 mm thick; areoles angular to irregular, 0.5–1 mm in diam., contiguous, convex, rough; Upper surface gray to gray-brown, matt or somewhat shiny; prothallus present, black to brown-black, 0.1–0.5 mm wide. Apothecia 0.2–0.5(–0.7) mm in diam., aspicilioid, 1–3 per areole, round or angular; thalline margin thin, slightly raised, concolorous with the thallus, sometimes forming a white rim when young;

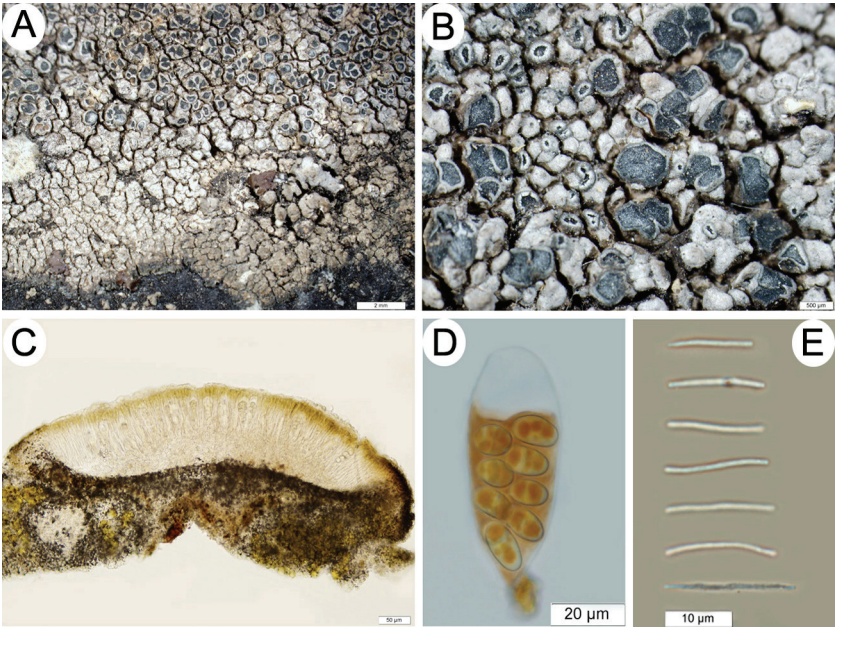

Figure 2. *Aspicilia verrucigera* (J.Z. Zhao 20050703-9). A. Habitus; B. Apothecia; C. Apothecial anatomy; D. Ascus and ascospores after I treatment; E. Conidia. Scale bars: A = 2 mm; B = 500 µm; C = 50 µm; D = 20 µm; E = 10 µm.

DISC black, bare or with slight pruina; EPITHECIUM olive-green to olive-brown, K+ brown, N+ green; HYMENIUM hyaline, I+ blue to green-blue, 87.5–125 µm high; PARAPHYSES separating in KOH, moniliform; SUBHYMENIUM and HYPOTHECIUM colorless, I+ blue, together 37.5–50 µm thick, without algae below the hypothecium. ASCI clavate, 8-spored, *Aspicilia*-type; ASCOSPORES hyaline, simple, ellipsoid, 12.5–17.5×7.5–10 µm; CONIDIA filiform, 15–22.5× 0.8–1 µm.

SPOT TESTS — Medulla K+ yellow, C–, I–, P+ orange.

SECONDARY METABOLITES — Stictic acid (major), norstictic acid (minor).

SPECIMENS EXAMINED — **CHINA. XINJIANG,** KANASI, alt. 1350 m, on siliceous rock, 3 Jul. 2005, J.Z. Zhao 20050703-9 (SDNU); **QINGHAI,** MENYUAN COUNTY, Fengxiakou, alt. 3300 m, on siliceous rock, 3 Aug. 2007, Y.D. Du 20070248 (SDNU).

COMMENTS — *Aspicilia verrucigera* is characterized by its numerous small apothecia and the presence of stictic acid. Morphologically, this species is easily confused with *Aspicilia cinerea* (L.) Körb., which has a gray K+ red thallus and norstictic acid as major metabolite. *Circinaria caesiocinerea,* which is similar to *A. verrucigera* in thallus color and thalline margin, differs by its larger spores, short conidia, and the presence of aspicilin. *Aspicilia dudinensis* (H. Magn.) Oxner also resembles *A. verrucigera* in its verrucose or prominent areoles but is easily separated by the K+ orange thallus reaction, a different exciple color, and smaller spores.

Aspicilia verrucigera is distributed on siliceous rocks from sea level to the mountains and has been reported from Europe (Magnusson 1939) and North America (Owe-Larsson et al. 2007).

Aspicilia subdepressa (Nyl.) Arnold, Verh. Ges. Wien 19: 611. 1869. FIG. 3

THALLUS crustose, rimose, areolate, areoles 0.2–1.2 mm in diam., ± 0.3 mm thick, angular to irregular, or sometimes round, contiguous, smooth, somewhat convex, indistinctly lobed, and the edge of the areoles is often slightly lifted upward; UPPER SURFACE gray to green-gray, sometimes brownish gray, matt; prothallus absent. APOTHECIA 0.3–0.7 mm in diam., aspicilioid, ordinarily solitary, or 2 per areole; DISC brown or black, not pruinose; thalline margin prominent when old, concolorous with the thallus; EPITHECIUM brown or olive-brown, K+ brown, N+ green; HYMENIUM hyaline, colorless, 100–150 µm high, I+ blue; PARAPHYSES submoniliform to moniliform, separating in KOH; SUBHYMENIUM and HYPOTHECIUM colorless, I+ blue, together 25–37.5(–50) µm thick, with algae below the hypothecium. ASCI clavate, 8-spored, *Aspicilia*-type; ASCOSPORES hyaline, simple, ellipsoid, (12.5–)15–20(–22.5) × (7.5–)10–12.5(–15) µm, CONIDIA filiform, straight or slightly curved, 7.5–12 × 0.8–1 µm.

SPOT TESTS — Medulla K+ yellow, C–, I–, P+ orange.

SECONDARY METABOLITES — Stictic acid.

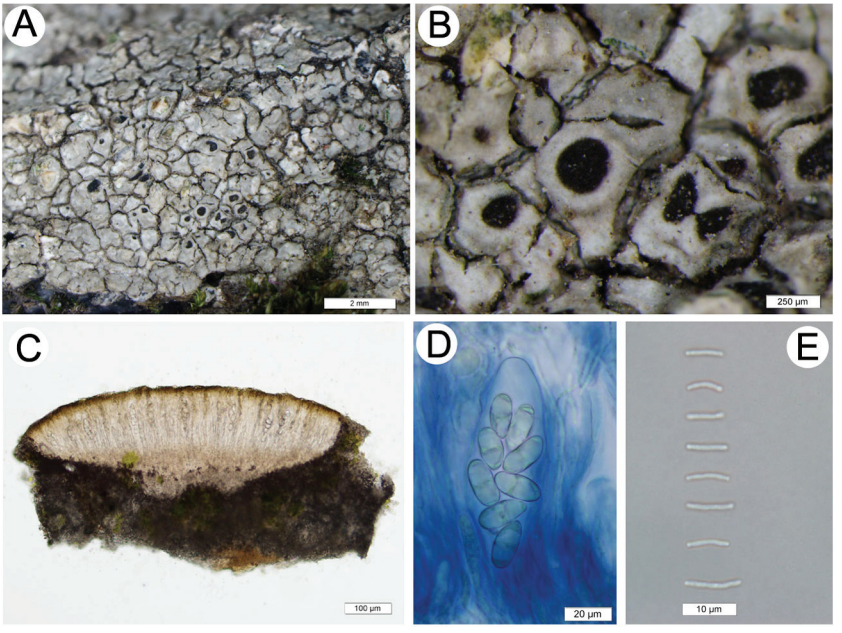

Figure 3. *Aspicilia subdepressa* (Q. Ren 2011304). A. Habitus; B. Apothecia; C. Apothecial anatomy; D. Ascus and ascospores after I treatment; E. Conidia. Scale bars: A = 2 mm; B = 250 µm; C = 100 µm; D = 20 µm; E = 10 µm.

Specimen examined — **China. Heilongjiang.** Wudalianchi city, Wudalianchi, Shihai, alt. 4400 m, on rock, 14 Jul. 2011, Q. Ren 2011304 (SDNU).

Comments — *Aspicilia subdepressa* is characterized by its smooth grayish thallus, short conidia, and the presence of stictic acid. *Aspicilia cupulifera* (H. Magn.) Oxner is morphologically similar to *A. subdepressa* but has a K+ nebulous yellow exciple, intensely branched paraphyses, and a lower hymenium. *Aspicilia proluta* (Nyl.) Hue has several features in common with *A. subdepressa*, such as a smooth thallus, short conidia, and the same major metabolite, but it is distinguished by its gray or bluish thallus, different habitat, and lack of prominent thalline margin.

Aspicilia subdepressa has been reported from France, from Pyrénées-Orientales (Roux et al. 2011) and Massif Central (Magnusson 1939), where it grows on rocks.

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